Chapter 6 Ford Testing

This chapter provides information and procedures for using the scan tool with the following control systems:

- Engine & Powertrain
- Transmission
- ABS (Antilock Brake System)
- GEM (Generic Control Module)
- CTM (Central Timer Module)
- FEM (Front Electronic Module)
- REM (Rear Electronic Module)
- PATS (Passive Anti-Theft System)
- RCM (Restraint Control Module)
- SCLM (Steering Column Lighting Module)
- ICM (Instrument Cluster Module)
- HEC (Hybrid Electronic Cluster)
- VIC (Virtual Image Cluster)
- 4X4
- Transfer case
- 4EAT (4-speed Electronic Automatic Transmission)
- ECS (Electronic Crash Sensor)
- IABM (Integrated Airbag Module)
- SRS (Supplemental Restraint System)

For additional information on Ford vehicles, see the following sections:

- “Ford Operations” on page 53
- “Ford Data Parameters” on page 291
- “Ford Communications Problems” on page 717

6.1 Testing Engine & Powertrain Systems

After selecting ENGINE & POWERTRAIN from the System Selection menu, the MAIN MENU - PCM displays (Figure 6-1). Selections vary by model and year.

```
MAIN MENU - PCM     MOVIES
>DATA DISPLAY       CUSTOM SETUP
 CODES MENU
 FUNCTIONAL TESTS
```

Figure 6-1 *Sample Ford MAIN MENU—PCM*

This section is divided into the following subsections:

- “Codes Menu” on page 72
- “Functional Tests” on page 84
- “Data Display” on page 99

The MOVIES and CUSTOM SETUP options are discussed in detail in the user’s manual for your scan tool.

6.1.1 Codes Menu

Selecting CODES MENU from the MAIN MENU - PCM gives you several options for working with diagnostic trouble codes (DTCs). There are slight differences between EEC-IV (Figure 6-2) and EEC-V (Figure 6-3) Codes menus.

```
CODES MENU              (CODE SPEED = FAST)
>KOEO SELF-TEST        CODE SPEED
 KOER SELF-TEST        CLEAR CODES
 REVIEW CODES          PRINT CODES
```

Figure 6-2 *Sample EEC-IV codes menu*

```
CODES MENU              FRZ FRAME/PENDING
>KOEO SELF-TEST        CLEAR CODES
 KOER SELF-TEST        MEMORY CODES
```

Figure 6-3 *Sample EEC-V codes menu*

CODES MENU options are discussed in the following sections:

- “KOEO Self-Test” on page 73
- “KOER Self-Test” on page 75
- “Code Speed” on page 81
- “Memory Codes” on page 81
- “Clear Codes” on page 81
- “Review Codes” on page 83
- “Print Codes” on page 83

NOTE:
FRZ FRAME/PENDING opens a menu of codes options that work the same as OBD-II Codes & Data menu items of the same name.

A Note about Service Codes

Ford refers to DTCs as “service codes,” and classifies them as on-demand codes and continuous codes.

- On-demand codes occur during either a key-on, engine-off (KOEO) self-test, or a key-on, engine-running (KOER) self-test.
- Continuous codes are memory codes from the PCM. These indicate intermittent problems that occurred in the past during normal vehicle operation. Memory codes cannot be set while running a self-test. Microprocessor Control Unit (MCU) and EEC-III systems do not have memory codes. Some DTCs only set as continuous codes.

During the KOEO self-test, EEC-IV systems transmit any on-demand codes first, followed by any continuous codes. An EEC-IV system does not transmit continuous codes during the KOER self-test, except on some 1983 Escort models with a 1.6L engine. An EEC-V system does not generate continuous codes during either the KOEO or KOER self-test. Instead, continuous memory codes are generated by selecting CODES MENU > MEMORY CODES.

To assist in diagnosing intermittent faults, engine-off and engine-running wiggle tests are available as functional tests on EEC-IV systems. These tests place the scan tool and PCM in a standby mode to allow checking for intermittent problems caused by wiggling electrical harnesses. If a fault occurs during a wiggle test, the PCM records it as a continuous code. The KOEO test must be run to read codes set during a wiggle test.

Earlier EEC-IV systems display DTCs as a 2-digit numerical code. Many 1991 and later EEC-IV vehicles transmit 3-digit service codes. An EEC-V system displays DTCs in the 5-digit OBD-II format.

Be aware that Ford DTC P1000 sets on an EEC-V system any time one of the following conditions is met:

- DTCs are cleared
- Readiness monitors have not successfully completed
- The vehicle battery is disconnected

Unless required by a mandated inspection and maintenance program, it is not necessary to clear DTC P1000 after a vehicle has been serviced. This code automatically clears upon the successful completion of all the readiness monitors. The only way to clear a DTC P1000 is through a Drive Cycle Test.

EEC-IV Ignition Key Cycles

A basic guideline for Ford testing is to turn the ignition key off, wait 10 seconds, then turn the key back on before repeating any particular test. This is not absolutely required on all vehicles, but it is good practice in order to avoid erroneous self-test actions by the PCM.

Instructions on-screen tell when it is advisable to turn the key off and back on, or to restart the engine before proceeding. You may choose whether or not to follow these instructions. If test results appear erroneous or incomplete, or the PCM does not respond, switch the key off, wait 10 seconds, then restart the test.

KOEO Self-Test

The KOEO SELF-TEST selection displays on-demand codes present with the ignition on and the engine not running. These are usually electrical open and short circuits and must be serviced first, before any other codes. On EEC-IV systems, the KOEO test displays continuous memory codes of intermittent faults from PCM memory. On an EEC-V system, the

continuous memory codes are accessed by selecting MEMORY CODES. Memory Codes are serviced last, after any on-demand codes.

EEC-III KOEO Self-Tests

The KOEO SELF-TEST selection on a Ford EEC-III system displays a checklist based on preliminary tests recommended by Ford. Ford advises these checks be completed before performing an engine-running test. These checks are also helpful for troubleshooting a no-start condition.

EEC-IV KOEO Self-Tests

The KOEO SELF-TEST selection for EEC-IV systems displays on-demand codes that are present with the ignition on but the engine not running, as well as continuous codes of intermittent faults from PCM memory.

Any of the KOEO on-demand codes are usually the result of electrical open and short circuits and must be serviced before any other codes. Continuous codes should be serviced last, after any on-demand codes.

The scan tool displays on-demand codes first, followed by continuous memory codes. This is the order in which they must be repaired. If no codes are present, a “11 System Pass” message displays. If codes are present, they display by number and description (Figure 6-4).

```
REVIEW CODES
33 EGR VALVE NOT OPENING
71 IDLE TRACKING SW STUCK OR CKT PROBLEM
95 FUEL PUMP CKT OPEN - ECA TO GROUND
```

Figure 6-4 *Sample EEC-IV Review Codes screen*

To select a KOEO self-test for EEC-IV:

1. Select **KOEO SELF-TEST**.

   The KOEO self-test confirmation screen displays.

2. Press **Y** and “self-test initiated wait for codes” displays.

   After 45 to 60 seconds when reading fast codes, or a minute or more for slow codes, a “review codes” screen should display (Figure 6-5). If the “wait for codes” message is on-screen for more than a few minutes, the test probably did not start. Refer to “Ford Communications Problems” on page 717 to diagnose the cause of a self-test failure.

```
REVIEW FAST CODES
** KEY ON, ENGINE OFF CODES-FIX FIRST **
11 SYSTEM PASS
** CONTINUOUS MEMORY CODES-FIX LAST **
```

Figure 6-5 *Sample EEC-IV screen with no codes present*

NOTE:
The last line reads “End of List” when you reach the end, but this does not necessarily mean that the test is complete, especially with slow codes.

EEC-V KOEO Self-Tests

The KOEO self-test for EEC-V is similar to that for EEC-IV. The main difference is that the EEC-V is OBD-II compliant, so it transmits 5-digit DTCs. No memory codes, or “soft codes,” are gathered during the KOEO self-test with EEC-V.

Memory clearing, also called PCM reset, is required to switch off the MIL on EEC-V systems. Certain memory codes trigger the MIL, and they must be cleared to turn the lamp off. Drive symptoms may appear or disappear when the PCM is reset.

To select a KOEO self-test for EEC-V systems:

1. Select **KOEO SELF-TEST**.

   The KOEO self-test confirmation screen displays.
2. Press **Y** and a “self-test initiated wait for codes” message displays.

   The KOEO self-test takes about 30 to 60 seconds to complete, then the “service codes” screen should display (Figure 6-6). If the “wait for codes” message stays on the screen for more than 2 to 3 minutes, the self-test probably did not run. Refer to “Ford Communications Problems” on page 717 to diagnose the cause of a self-test failure.

```
SERVICE CODES
** KEY ON, ENGINE OFF CODES-FIX FIRST **
    P1234 SAMPLE DTC
** END OF LIST **
```

Figure 6-6 *Sample EEC-V services codes screen*

MCU KOEO Self-Tests

The KOEO self-test for an MCU system displays on-demand codes that are present with the ignition on and the engine not running. This is a limited function system that only controls fuel mixture at cruise speed. There is no idle speed, timing, or EGR control. Fuel corrections are made in response to O2S feedback.

KOEO self-tests for MCU systems and EEC-IV systems are similar (see “EEC-IV KOEO Self-Tests” on page 74), except MCU does not output continuous codes of intermittent faults and does not perform wiggle tests. Also, self-tests detect only MCU-related faults. Problems outside of the MCU control system do not set codes. Use the KOEO self-test for EEC-IV systems described on “EEC-IV KOEO Self-Tests” on page 74 to test an MCU system.

KOER Self-Test

Selecting KOER SELF-TEST displays on-demand codes present with the engine running. Service these codes after KOEO on-demand codes and before memory codes. Most Ford vehicles do not perform a KOER test if any KOEO hard codes are present and uncorrected.

The entire engine-running test usually takes about 1 to 3 minutes for an EEC-V system or an EEC-IV system when reading fast codes. The time varies depending on the particular application and the number of codes. The test takes longer on EEC-IV systems with slow codes. The “self-test initiated wait for codes” message means that the scan tool attempted to start the test, but it does not mean the PCM responded. If the message stays on the screen for more than 2 to 3 minutes with no code response, the test probably did not start.

NOTE:
A rough-running engine may produce false KOER DTCs.

The scan tool displays only on-demand codes for faults present during the engine-running test. Diagnose and repair problems in the order in which codes display. Repair any KOEO on-demand codes first, before diagnosing codes from the KOER self-test.

If codes are not present, a “System Pass” message displays. If codes are present, they display by number and description (Figure 6-7).

```
REVIEW CODES
33 EGR VALVE NOT OPENING
71 IDLE TRACKING SW STUCK OR CKT PROBLEM
95 FUEL PUMP CKT OPEN - ECA TO GROUND
```

Figure 6-7 *Sample KOER self-test review codes screen*

Other engine systems may require different operator actions during the engine-running test. Some MCU systems, for example, require that engine speed be held at a specified RPM during the test. The scan tool displays any special instructions when required.

EEC-III KOER Self-Test

The KOER self-test is programmed into the PCM; codes recorded during the test display afterward. The EEC-III system has no long-term memory; it records and displays only on-demand codes. However, the scan tool stores codes for later review or printing. Repeating the EEC-III self-test erases memory and stores the codes from the latest test.

If the KOER self-test does not start, the display does not change when vacuum is released. If this happens, apply vacuum to the BMAP sensor again and release it quickly to trigger the test. If a test repeatedly will not start, refer to “Ford Communications Problems” on page 717.

In some cases, the EEC-III system may not complete the self-test if certain engine conditions are out of limits. For example, if the engine is not fully warm or if an engine coolant temperature (ECT) sensor circuit problem exists, the KOER self-test routine may stop before checking fuel control and air injection. The scan tool automatically displays any codes recorded and transmitted up to the point where the test stopped.

The code display is a valid report of system problems. Diagnose and correct the condition that caused the code. This may be as simple as ensuring that the engine is fully warm and repeating the test. After the problem is corrected, always repeat the test to be sure that the code is not reset and that no other codes are present.

NOTE:
A hand-operated vacuum pump is needed to trigger the KOER self-test on all EEC-III systems except 1983 5.0L trucks.

To select an EEC-III KOER self-test (except 1983 5.0L trucks):

1. With the ignition switched off, select **SERVICE CODES > KOER SELF-TEST**.
   The test screen displays (Figure 6-8).

```
*ENGINE-RUNNING SELF-TEST*
START ENGINE AND RUN AT 2000 RPM
FOR 2 MINUTES, OR UNTIL EGO IS WARM.
PRESS Y WHEN DONE.            [ 1.23]
```

Figure 6-8 *Sample EEC-III KOER self-test screen*

2. Be sure the ignition has been off for 10 seconds; then start and run the engine at 2000 RPM for 2 minutes to reach normal operating temperature and enter closed loop.
   The timer at the lower right of the screen counts time as the engine warms up. If the engine is not fully warm, the self-test may not complete.
3. Press **Y** and an initiation message displays (Figure 6-9).

```
INITIATE SELF-TEST BY APPLYING 22”HG.
VACUUM ON THE VENT PORT OF THE BMAP
SENSOR FOR 8 SECONDS, THEN RELEASE.
```

Figure 6-9 *Sample EEC-III KOER self-test initiation screen*

4. Apply 22 inHg of vacuum to the vent port of the barometric and manifold absolute pressure (BMAP) sensor. Hold vacuum for about 8 seconds; then release it. The vacuum release triggers the self-test.
   A “test initiated wait” message displays. The EEC-III system cycles through the self-test, and a code list displays at the end of the test:
   a. If no codes are present, “11 system pass” displays.
   b. If codes are present, they display in numerical order.

1983 EEC-III Carbureted Truck KOER Self-Tests

A different method, rather than releasing BMAP sensor vacuum, is used to trigger a KOER self-tests on 1983 trucks with a 5.0L or 5.8L carbureted engine. Connect the MULTI-1 adapter as shown in Figure 6-10.

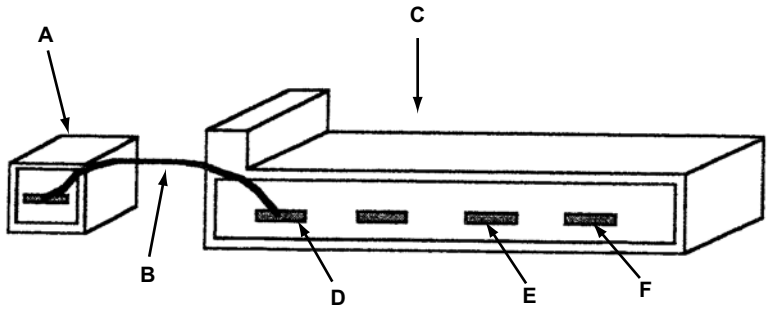

Figure 6-10 *EEC-III test connector*

A—STI pigtail
B—Jumper wire
C—EEC-III STI connector
D—Black MULTI-1 wire
E—Blue MULTI-1 wire
F—Brown MULTI-1 wire

To perform a KOER self-test on these models:

- On trucks with a 5.0L 2-barrel (code F) engine, connect a jump wire from the STI pigtail (pink wire) to ground (Figure 6-10), wait 8 seconds, then disconnect the jump wire to start a self-test.
- For all other 5.0L carbureted truck engines, connect a jumper wire from the self-test input (STI) pigtail to the ground terminal in the EEC-III test connector for 8 seconds. Then, remove the jumper to start the test.
- On trucks with a 5.8L carbureted engine, route manifold vacuum to the tee in the thermactor air bypass valve line before running the test.

EEC-IV and EEC-V KOER Self-Tests

On most 1988 and all 1989 and later models, the vehicle PCM does not enter the KOER self-test if any of the on-demand codes found during the KOEO self-test are not corrected. If KOEO on-demand codes are present, a “fix all hard codes” message displays when the KOER self-test is selected.

In some cases, the scan tool may display a message indicating that the cylinder identification cannot be found. If this happens, follow the procedure below.

To check for on-demand codes that have not been repaired:

1. Press **N** to return to the CODES MENU.
2. Select **REVIEW CODES**.
3. If no uncorrected codes are present, momentarily disconnect the scan tool from the vehicle to recall the vehicle ID from memory. Verify that the ID entered is correct.

To select a KOER self-test for EEC-IV and EEC-V:

1. Select **KOER SELF-TEST**.
   The test screen displays (Figure 6-11).

```
ENGINE RUNNING SELF-TEST
START ENGINE.  ALLOW ENGINE TO REACH
NORMAL OPERATING TEMPERATURE.
PRESS Y WHEN ENGINE IS FULLY WARM. [0:00]
```

Figure 6-11 *Sample EEC-V KOER self-test screen (EEC-IV is similar)*

An EEC-IV screen is similar to the EEC-V screen shown. Follow the on-screen instructions. The engine must be warm for test results to be valid. The timer at the right side of the bottom line counts minutes and seconds from when this test is selected. It counts to 9:59, then repeats from 0:00.

WARNING:
Keep hands and test leads away from the fan and other engine parts during all engine running tests. Certain components may cycle on at any time during engine running tests.

2. Press **Y** after 2 minutes and a test initiation message displays (Figure 6-12).

```
ENGINE RUNNING SELF-TEST
START ENGINE AND RUN AT IDLE.  DO NOT
ACCELERATE. PRESS Y TO CONTINUE (OR
PRESS Y BEFORE STARTING ENGINE).
```

Figure 6-12 *Sample KOER self-test initiation screen*

On an EEC-IV system, if you performed the engine-off test before the engine-running test, a “warning” message displays if the ignition was not switched off. This message means the self-test output (STO) circuit to the PCM is energized from a previous test. For some vehicles, you can ignore this message and press **Y** to enter the KOER test. If uncertain, turn the key off, wait 10 seconds, and test.

3. Press **Y** and “self-test initiated wait for codes” displays.

   You should hear engine speed change with most systems during the test if it progresses normally. Also, the screen changes and may make certain requests during the self-test. At the end of the KOER self-test, a code list displays.

Reading EEC-IV Slow Codes

If you choose to read slow codes during the KOER test, it takes longer to receive all of the codes. LED #1 flashes as the scan tool receives code pulses. The LED flickers briefly as the PCM transmits fast codes. It then pulses evenly as the scan tool receives the slow codes.

The PCM transmits on-demand codes. All of the code digit pulses are one-half second on and one-half second off. A two-second pause is used to separate the digits of each code, and a four-second pause separates the codes from each other. The entire test may take several minutes. The time it takes to run depends on the length of the code list.

CAUTION:
Do not press **N** to exit a KOER test until the last code pulse is received. Wait at least 5 to 10 seconds after the last LED flash before pressing **N** to exit. Pressing **N** sooner interrupts the code transmission and not all codes are received. “End of List” does not necessarily mean that the test is over.

MCU KOER Self-Tests

The KOER self-test for MCU systems displays on-demand codes that are present with the ignition on and the engine running. The MCU is a limited function system that only controls fuel mixture at cruise. There is no idle speed, timing, or EGR control. Fuel corrections are made in response to oxygen sensor feedback.

A KOER self-test for an MCU system is similar to that for an EEC-IV system (see “EEC-IV and EEC-V KOER Self-Tests” on page 78), except MCU does not output continuous codes and does not perform wiggle tests. In addition, the self-tests detect only MCU-related faults. Problems outside the MCU system do not set codes. Use EEC-IV and EEC-V KOEO self-test for procedures to test MCU.

NOTE:
MCU cylinders 4 and 6 require 2500 RPM before the test will initiate.

Cylinder Balance Test—EEC-IV SEFI Engines only

NOTE:
Operations described in this section are not available on all tool platforms.

The cylinder balance test, used only on EEC-IV models with sequential electronic fuel-injection (SEFI), is actually a functional test. However, it is entered at the end of a KOER self-test. The test isolates a weak cylinder.

The PCM begins the test by fixing the idle speed control duty cycle and allowing the engine to stabilize. The PCM then records and stores the engine speed for future reference. Depending on the engine, the PCM next shuts off fuel to cylinder 4, 6, or 8, allows the engine to stabilize, records and stores engine speed, and switches the fuel back on. This step repeats for each remaining cylinder in descending order.

Once all cylinders have been measured, the PCM selects the maximum RPM drop that occurred and multiplies it by a percentage. For the first stage of testing, 65% is used. For example:

150 RPM x 65% = 98 RPM

The result—98 RPM in the example—is the minimum drop required by each cylinder to pass the test. If all cylinders meet the minimum drop, a pass code is output and no further testing is required. If a cylinder fails, a code for the offending cylinder is output. A first stage failure indicates the cylinder is firing, but is weaker than the other cylinders.

To conduct a cylinder balance test:

1. Press and release the throttle within two minutes after the KOER self-test codes are output for a first stage test.
2. Quickly press and release the throttle within two minutes after the last code is output.

   Now, the test sequence repeats, but uses a percentage of 43 instead of 65. For example:

   150 RPM x 43% = 65 RPM

   The minimum drop required by each cylinder to pass the test is now reduced to 65 RPM. Again a pass code is output and no further testing is required if all cylinders meet the new

minimum drop. A code for the offending cylinder is output if a cylinder fails. Failure here indicates the cylinder is firing, but it is much weaker than the other cylinders.

3. Press and release the throttle within two minutes after the last code is output to perform the third stage test.

   This repeats the sequence using a percentage of 20. For example:

   150 RPM x 20% = 30 RPM

   The minimum drop required by each cylinder to pass the test is now only 30 RPM. If all cylinders meet the new minimum drop, a pass code sets. A code for the offending cylinder sets if a cylinder fails. Failure here indicates an extremely weak or dead cylinder.

Code Speed

Most EEC-IV systems transmit both slow codes and fast codes, and the scan tool reads either. The only difference between the slow and fast codes is the transmission speed from the system PCM. Typically, fast code transmission is the quickest and most accurate way to perform tests. However, some vehicles may not reliably transmit fast codes. On others, signal interference causes invalid service codes.

Use the CODE SPEED selection on the CODES MENU to choose the desired code-reading speed. On an EEC-IV vehicle, the CODE SPEED selection also allows choosing between automatic or manual clearing of continuous codes. Code speed selections remain as set until you change it, or until the internal battery is disconnected.

If you choose FAST CODES W/AUTOMATIC CODE CLEARING, the scan tool clears memory codes from the PCM automatically after reading the fast code transmission cycle during the KOEO test. If you choose slow codes, you must clear codes manually using the CLEAR CODES selection on the CODES MENU.

Selecting CODE SPEED opens the SELECT CODE SPEED menu (Figure 6-13).

```
SELECT CODE SPEED     [PRESS N TO EXIT]
>FAST CODES W/AUTOMATIC CODE CLEARING
 FAST CODES (NO AUTOMATIC CODE CLEARING)
 SLOW CODES (NO AUTOMATIC CODE CLEARING)
```

Figure 6-13 *Sample SELECT CODE SPEED screen*

Memory Codes

Available on powerstroke diesel and EEC-V systems only, selecting MEMORY CODES displays the continuous codes of intermittent faults from PCM memory. These codes should be serviced last, after any on-demand codes. On EEC-IV systems, memory codes gather at the end of the KOEO self-test.

Clear Codes

CLEAR CODES is available on EEC-IV and EEC-V systems only, this selection manually clears continuous codes from PCM memory. On EEC-IV systems, you have the option of clearing codes automatically after a KOEO self-test.

EEC-IV Code Clearing

The CLEAR CODES selection for EEC-IV systems is used to manually erase the PCM memory. When selected, the scan tool repeats the KOEO test, then interrupts the self-test input line to clear the PCM.

Ford service procedures advise clearing all codes after making repairs and then repeating the self-test to verify the repair. Note that continuous codes displayed during a self-test are saved in scan tool memory. If codes are cleared and the problem does not reoccur for an on-demand code when a self-test is repeated, the PCM does not set the code. Repeating a self-test erases the code list from a previous test in memory—including continuous codes—and replaces it with a new list.

NOTE:
This manual code-clearing method must be used if the code speed selection is set to read slow codes or fast codes with auto code clear. See “Reading EEC-IV Slow Codes” on page 79 for more information.

To clear codes on EEC-IV systems:

1. Select **CLEAR CODES**.

   A confirmation screen displays (Figure 6-14).

```
*CLEAR MEMORY CODES*
PRESS Y, THEN TURN KEY ON.  DO NOT START
THE ENGINE.
```

Figure 6-14 *Sample EEC-IV clear memory codes confirmation screen*

2. Press **Y** and switch the ignition on.

   The display changes to read “self-test initiated wait for code clearing.” After about 40 to 60 seconds, the “codes cleared” screen should display (Figure 6-15).

```
CODES CLEARED
PRESS N TO EXIT.
```

Figure 6-15 *Sample EEC-IV codes cleared message*

   If the codes cleared message does not appear after about 1 minute, refer to “Ford Communications Problems” on page 717 to diagnose a vehicle self-test failure.

EEC-V Code Clearing

The CLEAR CODES selection on EEC-V systems, which manually erases the PCM code memory, is similar to that for EEC-IV systems.

NOTE:
Before clearing codes on an EEC-V system, always check freeze frame data and pending DTCs with the FRZ FRAME/PENDING option on the CODES MENU.

To clear codes on EEC-V:

1. Select **CLEAR CODES**.

   A confirmation screen displays (Figure 6-16).

```
CLEAR CODES
 KEY MUST BE ON WITH THE ENGINE OFF OR
 RUNNING.  PRESS N TO EXIT WITHOUT
 CLEARING.  PRESS Y TO CLEAR CODES.
```

Figure 6-16 *Sample EEC-V clear codes confirmation screen*

2. Press **Y**.

   A “self-test initiated” message displays. After about 40 to 60 seconds, the “codes cleared” screen should display (Figure 6-15). If the codes cleared message does not appear after about 1 minute, refer to “Ford Communications Problems” on page 717.

Review Codes

The REVIEW CODES selection is available on the CODES MENU after running a self-test. This selection is available on EEC-III, MCU, EEC-IV, and EEC-V systems.

To review codes:

1. Select **REVIEW CODES**.
2. Repair faults in the order listed. Also, remember these points:
3. Review all codes until “end of list” appears.
4. Select FAST CODES W/AUTOMATIC CODE CLEARING for any EEC-IV system and the scan tool clears codes from the PCM automatically after a test but saves them in the scan tool memory.
5. The scan tool saves the codes from the most recent KOEO or KOER self-test for display in review codes. If a test is repeated, new codes replace previous ones.
6. Always record continuous memory codes after any EEC-IV test. They may be automatically cleared from the PCM, and subsequent tests may not display them.
7. If you are reading slow codes or fast codes without auto code clear on an EEC-IV system, the scan tool saves them in memory. However, the CLEAR CODES selection must be used to clear the PCM.

Print Codes

The PRINT CODES selection prints the service code list from scan tool memory. All printouts of the code list include the vehicle ID.

To print codes:

1. Select **PRINT CODES**.

   A “printing wait” message displays. After printing is complete, the message clears.

2. Press **N** at any time during the printing process to abort printing.

   The display returns to the CODES MENU before the printing is complete. If the printer does not respond or fails, a “not responding” message displays (Figure 6-17). If the printer problem is corrected, or if the printer recovers, the display returns to the normal printing screen and the printer resumes printing.

```
PRINTING                                WAIT.
PRESS N TO ABORT PRINTING.
PRINTER NOT RESPONDING.  CHECK PRINTER.
CHECK PRINTER PAPER.
```

Figure 6-17 *Sample printer not responding message*

MECS Service Codes

The CODES MENU selections for MECS models operate the same as described for an EEC-IV system. The MECS provides KOEO and KOER self-test selections, but the engine control system operates slightly differently than a Ford system.

Differences between MECS and Ford control systems are:

- The MECS control module continuously monitors engine operation for conditions that set codes. If no codes are present, the system does not transmit them to the scan tool. Because there are no codes, the display does not change when the “test initiated” screen displays. If the system does not respond within a few seconds, press **N** to return to the CODES MENU.
- An MECS system does not distinguish between on-demand and continuous memory codes. The code review summary lists only KOEO and KOER codes. Any memory codes are listed in numerical order with the KOEO codes.

NOTE:
All stored codes display after both self-tests. Disconnecting the battery ground cable clears PCM memory. Also press the brake pedal on Probe models. Repeat the self-tests for a list of on-demand codes. Any codes not repeated after clearing PCM memory were continuous memory codes.

- An MECS system is continuously monitoring for codes in a KOEO or KOER self-test. If a fault occurs during a self-test, the scan tool immediately displays the code on the screen.

6.1.2 Functional Tests

NOTE:
Operations described in this section are not available on all tool platforms.

The FUNCTIONAL TESTS selection is available for EEC-IV, EEC-V, and diesel systems, but menu items are completely different for all systems.

See “EEC-IV Functional Tests” on page 85 and “EEC-V Functional Tests” on page 94 for details.

For diesel systems, see the following sections:

- “Fuel Injection Pump Lever Test” on page 91
- “Output State Test” on page 95
- “Injector Buzz Test” on page 96
- “Glow Plug Test” on page 97
- “Cylinder Contribution Test” on page 97
- “Switch Test” on page 99

EEC-IV Functional Tests

NOTE:
Operations described in this section are not available on all tool platforms.

EEC-IV systems typically offer several functional tests (Figure 6-18). An additional Fuel Injection Pump Lever test (FIPL ADJUST) menu selection appears on trucks that have a 7.3L non-Powerstroke Diesel engine with an E4OD automatic transmission.

```
SCROLL TO SELECT A TEST.
>COMPUTED TIMING       CODE SPEED
 WIGGLE (ENGINE OFF)   OUTPUT STATE CHECK
 WIGGLE (RUNNING)      IDLE SPEED ADJUST
```

Figure 6-18 *Sample EEC-IV Functional Tests menu*

NOTE:
For EEC-IV vehicles, the ignition key should be switched off when selecting FUNCTIONAL TESTS from the MAIN MENU - PCM.

EEC-IV functional tests are described in the following sections:

- “Computed Timing Test” on page 85
- “Wiggle (Engine Off) Test” on page 86
- “Wiggle (Engine Running) Test” on page 87
- “Output State Check” on page 88
- “Idle Speed Adjustment Test” on page 89
- “Fuel Injection Pump Lever Test” on page 91

Computed Timing Test

The COMPUTED TIMING functional test checks ignition timing with the engine running at a controlled idle speed. It also verifies the ability of the PCM to advance and retard timing. Connect either a timing light or a magnetic timing meter to the engine before testing.

On most EEC-IV engines, the PCM advances timing 20° above the base timing setting. So if the base timing specification is 10° BTDC, expect to read 30° BTDC with a timing light or meter. Refer to Ford service manuals for timing specifications and test procedures.

To conduct a computed timing test:

1. Select **COMPUTED TIMING**.
   The “timing check” screen displays (Figure 6-19).

```
*TIMING CHECK*  START ENGINE AND CHECK
TIMING WITHIN 2 MINUTES
TIMING SHOULD BE BASE +20°
PRESS N TO EXIT.
```

Figure 6-19 *Computed timing check screen*

NOTE:
A “warning” message displays (Figure 6-20) if the timing check test is selected with the engine running or with the ignition switch on. This means the PCM self-test output (STO) circuit is still energized from a previous test. On some vehicles, this message can be ignored. If uncertain, turn the key off, wait 10 seconds, restart the engine, then enter the test.

```
WARNING:  SELF-TEST OUTPUT IS ENERGIZED.
IF YOU HAVE RUN ANY SELF-TEST, TURN KEY
OFF, WAIT.  IF NO TEST HAS BEEN RUN,
PRESS Y TO CONTINUE.
```

Figure 6-20 *Sample self-test output energized warning*

2. With the engine warm and running at idle, press **Y** to start the test.
3. Check the timing with a timing light or timing meter within 2 minutes.

Wiggle (Engine Off) Test

Selecting WIGGLE (ENGINE OFF) puts the EEC-IV system into a program that records intermittent service codes that occur as you wiggle or tap on various engine sensors, actuators, and wiring connectors with the ignition on and the engine off.

To conduct a wiggle (engine off) test:

1. Select **WIGGLE (ENGINE OFF)**.
   The test initiation screen displays (Figure 6-21).

```
*WIGGLE TEST - KEY ON, ENGINE OFF*
TURN KEY ON.  DO NOT START ENGINE.
WITH KEY ON, PRESS Y TO CONTINUE
.....................................
```

Figure 6-21 *Sample engine off wiggle test initiation screen*

2. Switch the key on and press **Y**.

After a brief startup message, the test displays (Figure 6-22).

```
MOVE, WIGGLE, AND TAP THE HARNESS,
SENSORS, AND CONNECTORS.  DO NOT TURN
KEY OFF DURING TEST! PRESS N TO EXIT
.....................................
```

Figure 6-22 *Sample engine off wiggle test screen*

3. Wiggle or tap the engine sensors, actuators, and wiring connectors.

   The bottom line of the screen is blank until a fault occurs and a code sets. If a code sets, the bottom line displays a “memory code stored–run KOEO test” message. Always check for memory DTCs after a wiggle test.

NOTE:
Do not wiggle the test adapter loose from the self-test connector during this test or a false code may set. Always exit the test before turning off the ignition or a false code may result.

To read the service codes from a wiggle test:

- Select **CODES MENU > KOEO SELF-TEST**.

Wiggle (Engine Running) Test

Selecting WIGGLE (ENGINE RUNNING) from the EEC-IV Functional Tests menu places the EEC-IV system into a program that records intermittent service codes as you wiggle or tap on engine sensors, actuators, and wiring connectors with the engine running.

The test is not valid for the following engines because the self-test output line continuously switches from high to low, which could mask any faults detected by the Wiggle test:

- 1984–85 1.6L
- 1984–85 2.3L SVO
- 1985–86 2.3L turbo
- 1986 3.0L

To conduct a wiggle (engine running) test:

1. Select **WIGGLE (ENGINE RUNNING)**.

   The test instruction screen displays (Figure 6-23).

```
*WIGGLE TEST - ENGINE RUNNING*
START ENGINE AND RUN AT IDLE.  DO NOT
ACCELERATE.  PRESS Y TO CONTINUE (OR
PRESS Y BEFORE STARTING ENGINE).
```

Figure 6-23 *Sample engine running wiggle test instruction screen*

2. If the engine is running, a warning message displays. Switch the engine off, wait 10 seconds, then restart the test. Otherwise, start and run the engine at idle speed.
3. Once the engine is fully warm, press **Y** to enter the test.

The screen momentarily displays a test initiated message (Figure 6-24), then switches to the test screen (Figure 6-25).

```
    TEST INITIATED . . . WAIT
IF NO RESPONSE IN 30 SECONDS, SEE FORD
REFERENCE MANUAL -- APPENDIX B.
```

Figure 6-24 *Sample engine running wiggle test initiated screen*

```
MOVE, WIGGLE, AND TAP THE HARNESS,
SENSORS, AND CONNECTORS.  DO NOT TURN
KEY OFF DURING TEST! PRESS N TO EXIT
.....................................
```

Figure 6-25 *Sample engine running wiggle test screen*

4. Wiggle or tap on sensors, actuators, and wiring connectors.

   The bottom line of the screen is blank until a fault occurs and a code sets. When a code sets, the bottom line reads “memory code stored–run KOEO test,” but this message only appears during a fault. Always check for memory DTCs after a wiggle test.

NOTE:
Do not wiggle the test adapter loose from the self-test connector during this test, or a false code may set. Always exit the test before turning off the ignition.

To read the service codes from a wiggle test:

- Select **CODES MENU > KOEO SELF-TEST**.

Output State Check

Selecting OUTPUT STATE CHECK from the EEC-IV Functional Tests menu allows you to switch the PCM signals to the engine actuators on and off to take voltmeter readings. If the engine is running, turn it off before selecting the output state test.

NOTE:
The EEC-V menu selection is OUTPUT STATE TEST instead of OUTPUT STATE CHECK for EEC-IV systems. This difference is with terminology only; the function is the same.

To conduct an output state test:

1. Select **OUTPUT STATE CHECK**.

   The test initiation screen displays (Figure 6-26).

```
*OUTPUT STATE TEST*
PRESS Y, THEN TURN KEY ON.  DO NOT START
THE ENGINE.
```

Figure 6-26 *Sample output state test initiation screen*

2. Following the screen instructions, switch the ignition on with the engine off, then press **Y**.

CAUTION:
When the test begins, all actuators (except IAC and fuel injectors) should be off and the control circuits from the PCM should be high (above 10 V). Use the DVOM or lab scope to check actuators.

A "self-test initiated" screen displays, followed by the test screen (Figure 6-27).

```
TO TOGGLE ACTUATORS ON/OFF, SNAP THE
THROTTLE.  CHECK THE ACTUATORS
INDIVIDUALLY WITH A DVOM.
**  ACTUATORS OFF  **
```

Figure 6-27 *Sample output state test screen*

3. Press the accelerator to wide open throttle (WOT) to switch all engine actuators from off to on or from on to off.

   All of the actuators stay on or off until the throttle is pressed again. As the actuators change state, the bottom line of the display shows if they are on or off.

Idle Speed Adjustment Test

The IDLE SPEED ADJUST functional test allows you to adjust the idle speed for certain 1990 and later engines. Before adjusting idle speed, make sure the throttle body and idle speed control (ISC) device are clean, and the throttle linkage is not sticking or binding. Certain throttle bodies and ISC devices cannot be cleaned. Refer to Fast-Track® Troubleshooter, Ford Reference F051 for throttle body cleaning information.

Also, switch all accessories off and make sure the O2S is working properly, ignition timing is correct, and there are no vacuum leaks. Place the transmission in park or neutral before selecting the test.

A command from the scan tool starts the engine-running test, and a signal from the EEC-IV PCM indicates when the test is complete. During this waiting period, the cylinder identification displays along with instructions to press the brake pedal, turn the steering wheel, or snap the throttle. These actions are not necessary, however, doing them speeds the self-test.

CAUTION:
If any service codes other than "11–no faults present" are displayed after the engine-running test, correct any code problems before proceeding with the idle adjustment.

To conduct an idle speed adjustment test:

1. Select **IDLE SPEED ADJUST**.

   The test initiation screen displays (Figure 6-28). If another test was performed before this one, a "warning" screen may display because the self-test output (STO) circuit is still energized from the previous test. For some vehicles, it is safe to ignore this message and enter the test. If you are uncertain, turn the key off, wait 10 seconds, and restart the engine before entering the test.

```
*IDLE SPEED ADJUSTMENT*
START ENGINE AND RUN AT 2000 RPM
FOR 2 MINUTES, OR UNTIL EGO IS WARM.
PRESS Y WHEN DONE.                [0:00]
```

Figure 6-28 *Sample idle speed adjust test initiation screen*

2. Start the engine and run at 2000 RPM for two minutes.

   There is a clock displayed in the lower right corner of the screen. Skip this warm-up if the engine is already warm.

3. Press **Y** and the “test initiated” screen displays.

   Once the test is complete, the scan tool sends a start-idle-test signal to the PCM. The screen changes as the scan tool waits for a response from the PCM (Figure 6-29). Some 1991 5.8L truck engines do not have the idle speed test.

```
ENGINE RUNNING TEST COMPLETE.  READY FOR
IDLE SPEED TEST.  IF NO RESPONSE IN 15
SECONDS, IDLE TEST MAY NOT BE AVAILABLE
IN THIS EEC (SEE FORD REFERENCE MANUAL).
```

Figure 6-29 *Sample idle speed adjust test complete screen*

When the idle speed test signal is received from the PCM, the throttle stop screw adjustment screen displays (Figure 6-30). The display indicates if idle speed is too high, too low, or correct. If the display reads “TPS out of adjustment—fix first,” the throttle position sensor must be fixed to proceed. If idle speed is correct, skip to the last step.

```
TURN THROTTLE STOP SCREW TO ADJUST RPM.
PRESS N WHEN DONE AND RPM IS IN SPEC.
CURRENT CONDITION IS:
**  IDLE RPM________975
```

Figure 6-30 *Sample idle speed adjust throttle stop screen*

Ten minutes after the idle speed test signal is received, the PCM stops communicating. Normally, this is enough time to complete the adjustment. If not, return to the Functional Tests menu and repeat.

4. Turn the throttle stop until “idle RPM correct” displays.
5. Press **N** when the idle RPM is correct.

   An instruction and verification screen displays (Figure 6-31).

```
RUN ENGINE AT 1500 RPM FOR 10 SECONDS.
WHEN DONE, PRESS Y TO RECHECK BASE IDLE,
OR PRESS N TO EXIT.               [0:00]
```

Figure 6-31 *Sample idle speed adjust verification screen*

6. Run the engine at 1500 RPM for 10 seconds, return to idle, and press **Y**.

   An idle RPM correct message should display. If not, repeat the idle speed adjustment.

7. When the idle is properly adjusted, press **N** to exit.

Fuel Injection Pump Lever Test

The FIPL ADJUST selection is available on trucks with a 7.3L non-Powerstroke Diesel engine, an E4OD transmission, and an EEC-IV transmission control system.

The FIPL adjust test allows for FIPL sensor inspection and adjustment. Improper adjustment causes harsh upshifts and transmission damage.

NOTE:
Use a 0.515-inch gauge block (Ford tool T83-78200-AH, or equivalent) when performing this test. See Transmission Troubleshooter Reference F1002 for tool dimensions and usage.

The FIPL sensor attaches to the diesel injection pump and is operated by the throttle lever (Figure 6-32). The FIPL sensor transmits a signal to the transmission electronic control (TEC) module that varies in proportion to the amount of fuel being delivered by the pump. An FIPL sensor operates much like the throttle position sensor on a gasoline engine. The TEC uses the FIPL signal to control shifting and torque capacity, which results in line pressure changes. This is similar to a vacuum modulator or throttle valve linkage operation on a conventional automatic transmission.

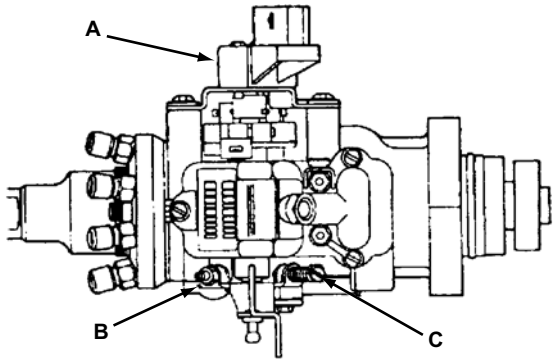

Figure 6-32 *Sample diesel fuel injection pump top view*

A—Fuel Injection Pump Lever (FIPL) sensor

B—Maximum throttle travel screw (do not adjust)

C—Low idle adjust screw

Two people are required to perform this test, one inside the vehicle to operate the scan tool and hold the throttle down, and one to make adjustments inside the engine compartment.

CAUTION:
Do not release the throttle with the gauge block in place, as the gauge block can fall inside the intake valley, making it difficult to retrieve.

NOTE:
When the FIPL sensor malfunctions, the TCM detects an out-of-limit signal and goes to a backup mode to protect the transmission. In this mode, the TEC commands maximum throttle valve (TV) pressure for a single shift schedule regardless of throttle position—equivalent to a heavy, but not wide open, throttle. Harsh upshifts, particularly noticeable at light throttle, result. An intermittent or erratic signal or an incorrectly adjusted FIPL sensor may not be detected by the TEC, resulting in shifting problems and possible transmission damage.

To conduct a FIPL adjust test:

1. Select **FIPL ADJUST**.
   The tool installation screen displays (Figure 6-33).

```
INSERT 0.515” GAUGE BLOCK BETWEEN FIPL
TRAVEL SCREW AND GAUGE BOSS.  HOLD
THROTTLE OPEN AGAINST GAUGE BLOCK (SEE
FORD REF MANUAL).  PRESS Y TO CONTINUE.
```

Figure 6-33 *Gauge block installation screen*

2. Insert the 0.515-inch gauge block between the gauge boss and the maximum throttle travel screw (Figure 6-34). Hold the throttle open against the gauge block to keep it in place.

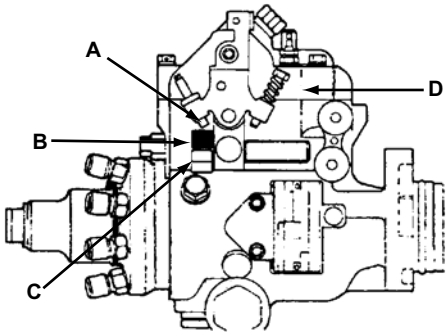

Figure 6-34 *Gauge block installation (right side view)*

A—Fuel pump lever travel screw (do not adjust)

B—Gauge block

C—Gauge boss

D—Low idle adjust screw

On F-series trucks, the throttle return spring may be used to hold the throttle lever open. To do this:

a. Release the throttle and remove the throttle cable from the throttle lever on the right side of the pump.
b. Remove the throttle return spring.
c. Install one end of the spring over the throttle lever ball stud and the other end over the throttle cable support bracket.

3. After inserting the gauge block, press **Y**.

The FIPL adjustment screen displays (Figure 6-35).

```
*FIPL ADJUSTMENT*
PRESS Y THEN TURN KEY ON.  DO NOT START
THE ENGINE.
HOLD THROTTLE DOWN DURING ENTIRE TEST.
```

Figure 6-35 *Sample FIPL adjustment screen*

4. Without starting the engine. Hold the throttle down, press **Y**, and turn the ignition on.

   A “self test initiated” screen displays, the scan tool starts the KOEO test, then waits for a signal from the PCM indicating that the vehicle is ready for FIPL adjustment. The display indicates when the FIPL adjust test is complete (Figure 6-36).

```
ENGINE OFF TEST COMPLETE.  READY FOR
FIPL ADJUSTMENT.  WITHOUT RELEASING
THE THROTTLE, PRESS THE OVERDRIVE CANCEL
SWITCH ONCE TO START FIPL ADJUSTMENT.
```

Figure 6-36 *Sample engine off test complete screen*

CAUTION:
Do not turn the key off until the FIPL Adjust test is complete and the engine off test complete message displays on the screen. Doing so gives inaccurate test results.

5. Press the overdrive cancel switch once to begin the FIPL test (Figure 6-37). The overdrive cancel switch is on the end of the shift lever or the instrument panel.

```
IF NECESSARY, LOOSEN FIPL SENSOR SCREWS,
AND ROTATE SENSOR TO CORRECT SETTING.
CURRENT CONDITION IS:
** FIPL SETTING IS_____________**
```

Figure 6-37 *Sample FIPL adjustment screen*

   Ten minutes after the overdrive-cancel switch is pressed, the PCM stops communicating with the scan tool. Normally, this is enough time to complete the test and adjustment. If not, exit the test, go to the Functional Tests menu, and repeat this procedure.

IMPORTANT:
Incorrect FIPL sensor adjustment may result in transmission damage. The sensor is attached to the pump with tamperproof screws. Do not move the mounting bracket. Only adjust the clearance between the sensor-to-bracket screws and the sensor.

6. If needed, adjust the FIPL sensor as follows and refer to Figure 6-38.
   a. Loosen the two FIPL sensor attachment screws.
   b. Slowly rotate the sensor until the display indicates the setting is correct. The FIPL sensor rotates slightly in either direction. Rotate the FIPL first one way, and then the other until properly adjusted. If the sensor cannot be properly adjusted, replace it.
   c. Tighten the screws to 75 to 90 inch-pounds of torque.
   d. Remove the gauge block and cycle the throttle lever from idle to WOT five times.

e. Use the gauge block and verify the FIPL setting. If further adjustment is necessary, repeat the procedure.

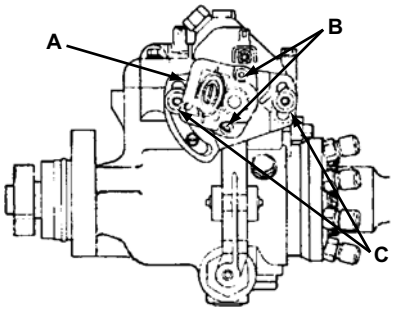

Figure 6-38 *Adjusting the FIPL sensor (left side view)*

A—Fuel Injection Pump Lever (FIPL) sensor

B—FIPL attachment screws (do not over-tighten)

C—FIPL bracket screws (do not adjust)

7. When the FIPL setting is correct, press N.
8. Remove the gauge block and attach the throttle return spring and throttle cable in the proper locations.
9. Press **N** to end the FIPL test.
10. After testing, drive the vehicle to check throttle operation and transmission shifting.

EEC-V Functional Tests

NOTE:
Operations described in this section are not available on all tool platforms.

The EEC-V Functional Tests menu offers two selections for vehicles with gasoline engines:

- Output State test
- Module Identification test

Up to five functional tests are available for trucks with 7.3L Powerstroke diesel engines:

- Output State test
- Injector Buzz test
- Glow Plug test
- Cylinder Contribution test
- Switch test

Two functional tests are currently available for 6.0L direct injection turbo (DIT) diesel engine:

- Injector Buzz test
- Glow Plug Engine Running test

Output State Test

An output state test allows you to switch PCM signals to the engine actuators on and off so they can be tested with a DVOM or lab scope. The engine must be off before the test is selected. Output state tests for gasoline and diesel systems are slightly different.

During an output state test, actuators stay on or off until you switch them. Actuators default to their normal state after 10 minutes, after the vehicle is started, or after cycling the ignition switches off and on.

CAUTION:
Make sure the fuel system is intact and not being serviced before proceeding. Selecting all outputs on causes the electric fuel pump to briefly energize. Also, make sure fan blades are clear of obstruction before selecting low or high speed fan on.

To conduct an output state test on a vehicle with a gasoline engine:

1. Select **OUTPUT STATE TEST**.
   A test activation screen displays.
2. Press **Y** and the test list displays (Figure 6-39).

```
>NORMALLY ON OUTPUTS OFF
 ALL OUTPUTS ON       LOW FAN ON ONLY
 HIGH FAN ON ONLY
```

Figure 6-39 *Sample EEC-V gasoline engine output state tests*

3. Select the desired test.
   If the vehicle performs the test, “activated” displays to the right of the selected test.
   If the vehicle does not perform the test, “error” displays to the right of the selected test.
4. Take circuit readings while the test is activated.

To conduct an output state test on a vehicle with a Powerstroke 7.3L diesel engine:

1. Select **OUTPUT STATE TEST**.
   A test activation screen displays (Figure 6-40).

```
KOEO OUTPUT STATE SELF-TEST
DEPRESS/RELEASE ACCELERATOR PEDAL TO
CYCLE OUTPUTS.  NO CODES AVAILABLE.
DEPRESS BRAKE PEDAL OR PRESS N TO EXIT.
```

Figure 6-40 *Sample EEC-V diesel engine output state test*

2. Press and release the accelerator pedal to cycle the output state of relays, solenoids, the transmission control indicator lamp (TCIL), the fuel delivery command signal (FDCS), the cylinder identification (CID) signal, the wait-to-start lamp, and the electronic feedback (EF) signal from the injector drive module (IDM).
3. Take circuit readings while the test is activated.
4. Press **N** or the brake pedal to exit.

Module Identification Test

The MODULE ID selection from the EEC-V Functional Tests menu is available on EEC-V gasoline and 7.3L Powerstroke Diesel engine models, displays the PCM module software file, part number, and, if available, the VIN of the vehicle.

To conduct a Module ID test:

1. Select **MODULE ID TEST**.

   An identification screen displays (Figure 6-41). If a module does not store VIN information, “not available” displays on the third line.

```
  SOFTWARE FILE:  CCAQAB3.HEX
MODULE PART #:  F4WFBD
          VIN:  XXXXXXXXXXXXXXXX
 Copyright Ford Motor Co. 1993
```

Figure 6-41 *Sample EEC-V module identification screen*

2. Press **Y** to print the screen, or press **N** to exit.

Injector Buzz Test

The injector buzz test performs an operational check of the injector solenoids and valves on 6.0L and 7.3L diesel engines. The engine must be off to run the injector buzz test.

CAUTION:
Make sure the fuel system is intact and that no fittings or connections are open for service before proceeding with the injector buzz test.

To conduct an injector buzz test:

1. Select **INJECTOR BUZZ TEST**.

   An instruction screen displays (Figure 6-42). Make sure all accessories, including auxiliary powertrain control, are shut off.

```
TURN OFF A/C AND ALL ACCESSORIES
 INCLUDING AUXILIARY POWERTRAIN CONTROL
 (RPM CONTROL), IF EQUIPPED.
 PRESS Y TO CONTINUE
```

Figure 6-42 *Sample EEC-V diesel engine injector buzz screen*

2. Press **Y** and switch the ignition on.
3. Press **Y** again to begin the test and “self-test initiated” displays.

   This means the scan tool attempted to start the test. It does not mean that the PCM responded. If the message stays on-screen for more than several minutes, the test probably did not start. Refer to “Ford Communications Problems” on page 717 to diagnose the cause of a self-test failure.

During the test, all injectors buzz together for about two seconds, then each injector buzzes individually in cylinder sequence, 1 through 8, for about one second. At the end of the test, a service code list displays (Figure 6-43).

```
SERVICE CODES:
**  ON DEMAND SELF-TEST CODES  **
P1111 SYSTEM PASS
**  END OF LIST  **
```

Figure 6-43 *The injector buzz test service code list*

Glow Plug Test

The glow plug test checks of the glow plugs on 7.3L EEC-V diesel engines.

NOTE:
The vehicle batteries must be in good condition and the charging system working properly before testing. During the test, battery voltage must be above 11.8 V and below 14.0 V. Connect a DMM to the battery to monitor voltage. If necessary, raise the engine speed during the test to maintain battery voltage.

To conduct a glow plug test:

1. Select **GLOW PLUG TEST**.

   A “turn off accessories” message displays. Make sure all accessories, including auxiliary power control, are off before beginning the test.

2. Press **Y**.

   The begin test screen displays (Figure 6-44).

```
AUTO TRANS IN PARK OR MANUAL TRANS IN
 NEUTRAL.  BATTERY VOLTAGE MUST BE 12V
 TO 14V, START ENGINE, RAISE RPM IF
 NECESSARY.  PRESS Y TO BEGIN TEST.
```

Figure 6-44 *Sample EEC-V diesel glow plug test*

3. Press **Y**.

   The “self-test initiated” message displays, which means the scan tool has attempted to start the test. It does not mean the vehicle responded. If the message remains on-screen for more than several minutes, the test probably did not start. Refer to “Ford Communications Problems” on page 717 to diagnose the cause of a vehicle self-test failure. When the PCM finishes the test, a service code list automatically displays.

Cylinder Contribution Test

The cylinder contribution test monitors individual cylinders and injectors to determine if all are contributing equally to engine performance.

The PCM first checks each cylinder sequentially, 1 through 8, to make sure they are all contributing. The test checks for cylinder-to-cylinder decrease in speed and sets a code if the

decrease is too high. A fault must be present at the time of testing for the KOER Cylinder Contribution Self Test to detect a fault, so the engine operating condition at which the idle is worst will produce the best test results.

Note the following when performing a Cylinder Contribution test:

- Only California vehicles will set a Continuous Misfire DTC. Both 49-state and California vehicles will set a KOER Cylinder Contribution Test (CCT) code for a low or non-contributing cylinder. If any CCT or Misfire codes are set, diagnose those codes first.
- Late-model Powerstroke Diesel engines run this test without any obvious cylinder shorting or RPM change. Test results are the same.

Possible causes of a misfiring cylinder are:

- Broken compression rings
- Leaking or bent valves
- Bent push rods
- Bent connecting rods
- Damaged rocker arms
- Faulty injector

Before starting repairs, perform basic engine diagnostic tests. If all systems are operating within specifications, the injector may not be functioning properly and may need replacement. Also be sure to check the solenoids and wiring. Verify that the KOEO Injector Electrical Self-Test has passed.

To ensure proper test results, the following conditions must be met:

- Engine oil temperature is above 68°F (20°C)
- A/C is off

To conduct a cylinder contribution test:

1. Select **CYLINDER CONTRIBUTION TEST**.

   A “turn off accessories” message displays. All accessories, including the auxiliary power control, must be off before beginning the test.
2. Press **Y**.

   The begin test screen displays (Figure 6-45).

```
ENGINE MUST BE RUNNING AND AT NORMAL
OPERATING TEMP.  AFTER TESTING, CYCLE
KEY TO OFF BEFORE DRIVING OR RUNNING
ANY OTHER TEST.  PRESS Y TO CONTINUE.
```

Figure 6-45 *Sample EEC-V diesel cylinder contribution test*

3. Press **Y**.

   The “self-test initiated” message displays. This message means the scan tool attempted to start the test. It does not mean the vehicle responded. If the message stays on the screen more than several minutes, the test probably did not start. See “Ford Communications Problems” on page 717 to diagnose the cause.

   During the test, some changes in engine RPM may occur. However, a weak cylinder has little effect on idle quality during the test.

When the PCM finishes the test, a service code list displays.

Switch Test

Selecting SWITCH TEST initiates a key-on, engine running test of various driver input circuits. This test is available for 7.3L diesel engines only.

CAUTION:
Always chock the vehicle wheels before performing an engine running switch test. This test requires parking brake apply and release.

To conduct a switch test:

1. Press **Y**.
   A test initiation screen displays (Figure 6-46).

```
KOER SWITCH TEST:  PRESS Y TO CONTINUE
 THEN DEPRESS/RELEASE:  ACCELERATOR TO
 START, PARKING BRAKE, SPEED CONTROL
 SWITCHES, TCS OR CLUTCH, BRAKE TO STOP.
```

Figure 6-46 *Sample EEC-V diesel switch test*

2. Press **Y** to continue.
   Verify the engine is running, then perform the driver inputs in the following order:
   a. Press and release the accelerator to start the test.
   b. Set and release the parking brake.
   c. Press and release the speed control switches.
   d. Press and release either the TCS switch or the clutch pedal.
   e. Press and release the brake pedal.
3. When the PCM finishes the test, a code list automatically displays.

NOTE:
False codes may set if the test sequence is followed improperly. Allow about 1 second between activation of each switch.

6.1.3 Data Display

The DATA DISPLAY test selection is available on the MAIN MENU - PCM of many 1990 and later Ford vehicles with an EEC-IV powertrain control module (PCM) and DCL, and also on most 1994 and later vehicles with an EEC-V PCM.

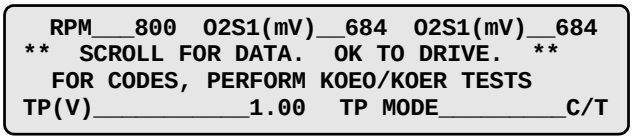

Figure 6-47 *Sample EEC-IV data display*

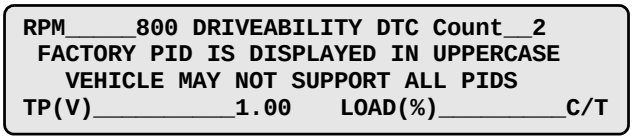

Figure 6-48 *Sample EEC-V data display*

These tests display the input and output signals from switches, sensors, and actuators. The speed at which the scan tool operates and displays data depends on the number of data parameters and how busy the vehicle control system is. This affects how quickly data changes on the screen, and the length of time it takes to display a movie. Differences in scan tool operation may be noticed from vehicle to vehicle. The data readings may appear to change almost instantly on some models, while they occur much slower on another vehicle. Certain parameters (especially switches) only change state if held in position.

The DATA DISPLAY selection requires the scan tool to communicate with the PCM. The ignition must be on to establish communication. If communication is not established within 5 seconds of the ignition switching on a “no communication” message displays (Figure 6-49).

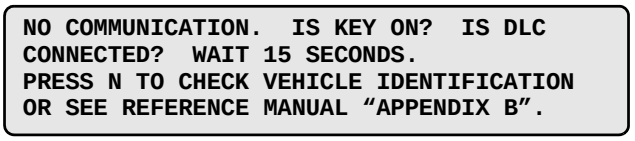
NO COMMUNICATION. IS KEY ON? IS DLC
CONNECTED? WAIT 15 SECONDS.
PRESS N TO CHECK VEHICLE IDENTIFICATION
OR SEE REFERENCE MANUAL “APPENDIX B”.

Figure 6-49 *Sample “no communication” message*

This message stays on the screen until communication is established, or the **N** button is pressed. Whenever communication is established, the display goes to the selected function.

EEC-V Data Display

When DATA DISPLAY is selected on an EEC-V system, the DATA MENU menu displays. This allows you to select groups of parameters for viewing (Figure 6-50).

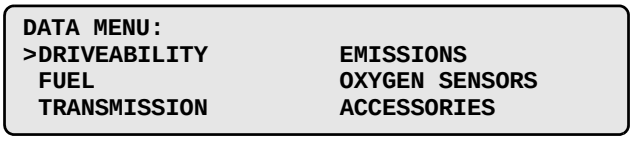

Figure 6-50 *Sample EEC-V data group selection*

Selecting any of the DATA MENU menu items causes the Custom Data menu to display (Figure 6-51). This feature allows you to customize the data list by selecting which data

parameters to display. Eliminating unneeded parameters results in a faster display update rate. The fewer parameters displayed, the faster the update rate.

```
SCROLL & PRESS Y TO SELECT/DESELECT
>DISPLAY DATA
 *SELECT/DESELECT ALL
 *TP(V)
```

Figure 6-51 *Sample EEC-V custom data list*

When the Custom Data menu is first entered, all parameters are selected, as denoted by the asterisk that appears before them. Custom data list selections are retained in scan tool memory until a new vehicle ID is entered or another vehicle control system is selected.

Be aware, this may limit Troubleshooter operation with tips that display data parameters.

NOTE:
For some vehicles, it may be necessary to access the Custom Data menu from the Exit menu.

To select custom data:

1. Select the parameter name to select or deselect it as noted by the appearance or disappearance of the asterisk.
2. To deselect all, select **SELECT/DESELECT ALL**.
3. After selecting the desired parameters, press **N** to display the custom data list.

6.2 Testing ABS Systems

Antilock brake systems (ABS) are available on many 1987 and later Ford, Lincoln, and Mercury vehicles. When a system malfunction occurs, the ABS electronic control module (ECM) illuminates the ABS warning lamp on the instrument panel.

On some systems, the ABS ECM stores service codes in memory for most malfunctions. These codes transmit to a scan tool through either the OBD-II DLC or the ABS test connector. In addition, some late-model ABS modules provide data stream information. Data stream information displays when the ABS control system provides it.

NOTE:
The following sections apply to ABS systems on vehicles with or without traction control.

After selecting ABS from the System Selection menu, the MAIN MENU - ABS displays (Figure 6-52). Selections vary by model and year.

```
MAIN MENU - ABS        CUSTOM SETUP
>DATA DISPLAY          CODES MENU
 MOVIES
```

Figure 6-52 *Sample Ford MAIN MENU—ABS*

This section is divided into the following subsections:

- “1994–96 Econoline Vans with 4WABS” on page 102
- “Codes Menu” on page 103
- “Data Display” on page 108

The MOVIES and CUSTOM SETUP options are discussed in detail in the user’s manual for your diagnostic tool.

6.2.1 1994–96 Econoline Vans with 4WABS

The FRD-4 test adapter is used for ABS testing on the 1994–96 Econoline with 4-Wheel Antilock Brakes (4WABS). A special connection message displays if one of these vehicles is identified (Figure 6-53).

NOTE:
Some 1997 Econolines also require the FRD-4 test adapter.

```
CONNECT FRD-4 ADAPTER TO ABS SELF-TEST
CONNECTOR LOCATED UNDERHOOD ON LEFT SIDE
NEAR MASTER CYLINDER OR LF SIDE OF DASH.
PRESS Y TO CONTINUE.
```

Figure 6-53 *1994–96 Econoline connection message*

To connect the FRD-4 adapter for these vehicles:

1. Turn the ignition switch to the off position.
2. Attach the FRD-4 test adapter to the data cable.
3. On the underhood ABS connector near the master cylinder, insert the red wire of the FRD-4 adapter into pin 571, which is a black wire with an orange tracer (Figure 6-54).

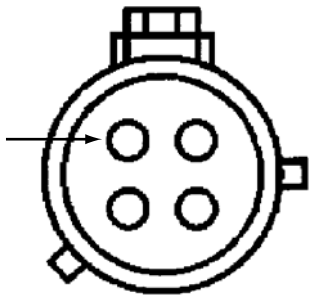

Figure 6-54 *Connector pin 571 on ABS DLC for 1994–96 Econoline with 4WABS*

4. Attach the Ground adapter (MT2500-41) to the black wire on the FRD-4 adapter (Figure 6-55).

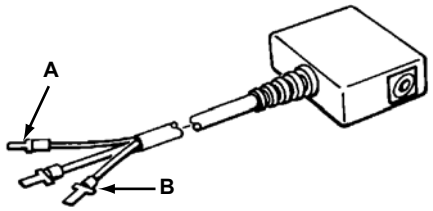

Figure 6-55 *FRD-4 adapter*

A—Black wire (to ground)

B—Red wire (to DLC Pin 571)

5. Connect the other end of the ground adapter to a known good ground (the green wire on the FRD-4 adapter is not used).

6.2.2 Codes Menu

During a KOEO self-test, the ABS ECM transmits on-demand codes (see “A Note about Service Codes” on page 72 for a description of on-demand codes). On most systems, continuous codes are gathered by selecting MEMORY CODES from the CODES MENU. Some early systems gather continuous codes automatically at the end of the KOEO self-test.

The CODES MENU displays when CODES MENU is selected from the MAIN MENU - ABS (Figure 6-56). Menu selections are:

- **KOEO SELF-TEST**—This test displays on-demand codes present with the ignition on, but the engine not running. These are usually electrical open and short circuits and must be serviced first, before any continuous codes. On some early systems, the KOEO test displays continuous codes. For these vehicles, the MEMORY CODES selection below does not appear.
- **MEMORY CODES**—Available on late-model systems only, this selection displays continuous codes of intermittent faults from ABS module. Memory codes should be serviced last, after any other codes generated by the KOEO self-test.
- **CLEAR CODES**—Clears continuous memory codes from the ABS ECM memory.
- **HOW TO GET CODES**—Only available on early systems with RABS, this selection gives instructions for manually gathering and clearing ABS codes.
- **REVIEW CODES**—Allows you to view gathered codes.
- **PRINT CODES**—Allows you to print gathered codes.

```
CODES MENU              REVIEW CODES
>KOEO SELF-TEST        PRINT CODES
 MEMORY CODES          CLEAR CODES
```

Figure 6-56 *Sample Ford ABS CODES MENU*

KOEO Self-Test

Selecting KOEO SELF-TEST initiates a self-test for ABS that is similar to that for engine testing. See “KOEO Self-Test” on page 73 for details.

To conduct a KOEO self-test:

1. Select **KOEO SELF-TEST**.

   A “key on” verification screen displays.

2. Make sure the ignition is switched on, then press **Y**.

NOTE:
Some systems require the ignition to be cycled on after pressing the Y button. Follow scan tool screen instructions.

A self-test initiated message displays (Figure 6-57). This message means the scan tool attempted to start the test, it does not mean the vehicle responded. If the message stays on the screen more than a few minutes, the test probably did not start. Refer to “Ford Communications Problems” on page 717.

```
SELF-TEST INITIATED...WAIT FOR CODES
.....................................
IF NO RESPONSE IN 60 SECONDS, SEE FORD
REFERENCE MANUAL -- APPENDIX B.
```

Figure 6-57 *Sample KOEO self-test initiated*

3. At the end of the test, the service code list displays (Figure 6-58).

```
ENGINE RUNNING SELF-TEST
START ENGINE AND RUN AT IDLE.  DO NOT
ACCELERATE.  PRESS Y TO CONTINUE (OR
PRESS Y BEFORE STARTING ENGINE).
```

Figure 6-58 *Sample ABS service code list*

If no codes are detected during the test a “P0000 no faults present” message displays.

Memory Codes

The MEMORY CODES selection displays continuous codes of intermittent faults from the ABS ECM. Some early-model vehicles automatically gather memory codes at the end of the KOEO self-test. Continuous codes should be serviced last, after servicing any on-demand codes found during the KOEO self-test.

To gather memory codes:

1. Select **MEMORY CODES**.

   A “key on” verification screen displays. Make sure the ignition is switched on.

2. Press **Y** to continue.

   A self-test initiated screen displays (Figure 6-57). This message means the scan tool attempted to start the test, it does not mean the vehicle responded. If the message stays on the screen more than a few minutes, the test did not start. Refer to “Ford Communications Problems” on page 717 to diagnose the cause of a self-test failure.

   When the ABS ECM finishes the test, the service code list displays. If no codes are detected during the test a “P0000 no faults present” message displays (Figure 6-59).

```
SERVICE CODES
** CONTINUOUS MEMORY CODES-FIX LAST **
P0000 NO CODES PRESENT
** END OF LIST **
```

Figure 6-59 *Sample ABS memory code list*

Clear Codes

Selecting CLEAR CODES from the CODES MENU erases any continuous codes from the ABS ECM memory.

On some systems, the KOEO test repeats and the scan tool then interrupts the self-test input line to clear ABS memory. Some early systems require the vehicle to be driven above 25 MPH (40 KPH) to clear codes.

If the CODES CLEARED does not appear after about one minute of completing a test, refer to “Ford Communications Problems” on page 717 to diagnose a vehicle self-test failure.

Note the following when clearing codes:

- Some systems prioritize DTCs. After repairing and clearing a DTC, always recheck for additional faults that may be present.
- Only continuous codes can be cleared. Codes that reappear when the KOEO self-test is repeated are on-demand codes that must be serviced. Be aware that certain codes, such as those for the wheel speed sensors and the pump motor, only set while the vehicle is being driven.

To clear the codes:

1. Select **CLEAR CODES**.

   A “key on” verification screen displays. Make sure the ignition is switched on.
2. Press **Y** to continue.

   A self-test initiated screen displays (Figure 6-60).

```
          SELF-TEST INITIATED
WAIT FOR CODE CLEARINGIF NO RESPONSE IN
60 SECONDS, SEE FORDREFERENCE MANUAL --
APPENDIX B.
```

Figure 6-60 *Sample code clearing in progress screen*

3. When the test finishes a codes cleared screen displays (Figure 6-61).

```
             CODES CLEAREDPRESS N TO
EXIT.
```

Figure 6-61 *Sample ABS codes cleared message*

Clearing Scan Tool Code Memory

The scan tool retains codes in its memory, which can be cleared doing any of the following:

- Repeat the test, which overwrites the previous code.
- Select a different system for testing.
- Enter a new vehicle ID.

Review Codes

Return to the service code menu from the KOEO self-test or memory code test and REVIEW CODES appears as a selection (Figure 6-62).

```
CODES MENU
>KOEO SELF-TEST        MEMORY CODES
                       CLEAR CODES
 REVIEW CODES          PRINT CODES
```

Figure 6-62 *REVIEW CODES available on the menu*

When this selection is available, it indicates recorded codes are in scan tool memory.

To review codes:

1. Select **REVIEW CODES**.

   A code list, similar to the lists displayed at the end of the self-tests, displays.
2. Fix the problems in the order listed. Also, remember these important points:
3. Review all codes until “end of list” appears.
4. The scan tool saves codes from the most recent test for display under review codes. On a re-test, codes from the previous test are replaced with a new list.
5. Always record continuous memory codes after any test.
6. If MEMORY CODES was selected, the scan tool saves the codes in memory, but the CLEAR CODES selection must be used to clear the ABS module memory.

Print Codes

A PRINT CODES selection is also available on the CODES MENU following either a KOEO self-test or a memory code test. All printouts of the code list include the vehicle ID.

To print the service code list from memory:

1. Connect the scan tool to a compatible printer.
2. Select **PRINT CODES**.

How To Get Codes (RABS Only)

This selection displays only when testing rear antilock brake systems (RABS) and provides information on diagnostic connector locations, code-flashing methods, code definitions, and basic code-clearing.

A RABS consists of the following:

- RABS module
- RABS valve
- Diagnostic connector
- Yellow antilock warning light
- Speed sensor
- Excitor ring (located in the rear differential housing)

The RABS module performs system tests and self-tests during startup and normal operation. If a problem is found, RABS is deactivated, the ABS lamp comes on, and a code may set.

A RABS-I vehicle only stores codes while the ignition is on. If a DTC is present, the ABS or RABS lamp goes on (no “pass” code). A RABS-II vehicle is equipped with a keep alive memory. DTCs remain in memory until the diagnostic connector is disconnected and the ignition is cycled off. A system with no detected faults transmits DTC 16. A base brake fault such as low fluid may cause the ABS lamp and possibly the red brake warning lamp to go on without storing a DTC. For information, refer to the Snap-on® ABS Troubleshooter Cartridge.

DTCs consist of short flashes followed by a series of long flashes. Count all flashes to read a DTC. A DTC will flash continuously until the key is turned off. It is best to read a DTC several times and disregard the first code output because part of the code may be lost when code output begins. On RABS-I or RABS-II, only one DTC is output at a time.

NOTE:
The ABS lamp will be on if a DTC is present. Leave the ignition on for the test or the DTC will be erased.

To access flashcodes on a vehicle with RABS-I:

1. Locate the RABS connector (see “Rear Antilock Brake System (RABS)” on page 67) and attach a jump wire to the black/orange wire.
2. Touch the jump wire to ground for 2 seconds and release.

   The ABS lamp should go out and then start the code flash sequence. A memory DTC is cleared whenever the ignition is cycled off.

To output additional codes:

1. Repair the code.
2. Restore the diagnostic connector.
3. Test drive the vehicle.
4. Repeat the procedure above to re-test.

To access flashcodes on a vehicle with RABS-II:

1. Locate the RABS connector (see “Rear Antilock Brake System (RABS)” on page 67) and disconnect the mating connector with the key on.
2. Attach a jump wire to the black/orange wire.
3. Touch the jump wire to ground for 2 seconds and release.

   The ABS lamp flashes a DTC[1]. To see additional codes, use the procedure for RABS-I.

To clear a memory DTC on a vehicle with RABS-II:

1. Disconnect the keep-alive memory power feed wire from the diagnostic connector.
2. Switch the ignition key off.
3. Reconnect the keep-alive memory power supply wire to the diagnostic connector lead after diagnosis is completed.

6.2.3 Data Display

The DATA DISPLAY selection for ABS systems operates similarly to Data Display for Ford engine testing. See “Data Display” on page 108 for details.

```
            CODES CLEARED
LF_WSPD(MPH)______3   RF_WSPD(MPH)______3
LR_WSPD(MPH)______3   RR_WSPD(MPH)______3
CCNTABS___________0   BOO ABS_________OFF
```

Figure 6-63 *Sample Ford ABS data list*

NOTE:
ABS functions are disabled during data communication. If the vehicle is driven, ABS will not function. ABS lamp may flash rapidly during data transmission.

ABS Data Communication Guidelines

Follow these steps to enter and exit ABS data:

1. Be sure the ignition is off when entering the vehicle ID.
2. Turn the ignition on.
3. Select **DATA DISPLAY**.
4. Turn the ignition off after completing ABS data tests.

6.3 Testing GEM, CTM, FEM, and REM Body Systems

The Generic Electronic Module (GEM) is available on many 1995 and later Ford vehicles. On some late-model vehicles, the GEM is referred to as the FEM (front electronic module) or REM (rear electronic module). For vehicles with the central timer module (CTM), the CTM option will display along with GEM; the CTM option never displays by itself.

Selecting GEM, GEM/CTM, FEM, or REM from the System Selection menu opens a main menu similar to Figure 6-64.

[1] RABS-II has the ability to retain the last failure DTC in memory, even if it occurs intermittently.

```
MAIN MENU (GEM)       CUSTOM SETUP
>DATA DISPLAY
 CODES MENU
 MOVIES
```

Figure 6-64 *Sample main menu for GEM, CTM, FEM, and REM*

These systems control numerous body system functions, including but not limited to:

- Power door locks
- Chimes
- Interior lighting
- 4x4 transfer case
- Wiper control

The circuits controlled by these systems vary, depending on the vehicle. All operate similarly and have the following functions available:

- KOEO Self-Test
- Gather and clear memory codes
- Review and print codes (only after codes have been gathered)
- View data parameters

During the KOEO self-test, the GEM transmits on-demand codes. Continuous codes are generated by selecting MEMORY CODES from the GEM CODES MENU.

Although CODES MENU options access tests specific to GEM-controlled electronics, scan tool operation is the same as for ABS CODES MENU options. Refer to “Codes Menu” on page 103 for detailed instructions.

6.3.1 Data Display

Before viewing data on some EEC-IV and all EEC-V vehicles, you are prompted to select a data parameter group from the Custom Data menu (Figure 6-65).

```
SCROLL & PRESS Y TO SELECT/DESELECT
>DISPLAY DATA
 *SELECT/DESELECT ALL
 *DTC CouNT
```

Figure 6-65 *Sample GEM CUSTOM DATA MENU*

The GEM Custom Data menu works exactly like the Engine Custom Data menu. See “EEC-V Data Display” on page 100.

6.4 Testing ICM, HEC, and VIC Body Systems

Selecting ICM/HEC or VIC MODULE from the System Selection menu opens a main menu similar to Figure 6-66.

```
MAIN MENU (ICM/HEC)    CUSTOM SETUP
>DATA DISPLAY
 CODES MENU
 MOVIES
```

Figure 6-66 *Sample main menu for ICM/HEC or VIC systems*

These systems have the following functions available:

- KOEO Self-Test
- Gather and clear memory codes
- Review and print codes (only after codes have been gathered)
- View data parameters

During the KOEO self-test, the ICM/HEC and VIC modules transmit on-demand codes. Continuous codes are generated by selecting MEMORY CODES from the CODES MENU.

Although CODES MENU options access tests specific to ICM/HEC- and VIC-controlled electronics, scan tool operation is the same as for ABS CODES MENU options. Refer to “Codes Menu” on page 103 for detailed instructions.

The DATA DISPLAY selection is available on most 1996 and later vehicles. It operates like Data Display for Ford engine testing. See “Data Display” on page 109 for detailed information.

6.5 Testing 4X4/Transfer Case Systems

Selecting 4X4 MODULE, 4X4 (UBP NETWORK), or TRANSFER CASE from the System Selection menu opens a main menu similar to Figure 6-67.

NOTE:
You will need to use the K-16 Personality Key™ device on UBP Network systems.

```
MAIN MENU (4X4)        CUSTOM SETUP
>DATA DISPLAY
 CODES MENU
 MOVIES
```

Figure 6-67 *Sample 4X4 systems main menu*

4X4/TRANSFER CASE systems have the following functions available:

- KOEO Self-Test
- Gather and clear memory codes
- Review and print codes (only after codes have been gathered)
- View data parameters

During the KOEO self-test, the 4X4 module transmits on-demand codes. Continuous codes are generated by selecting MEMORY CODES from the CODES MENU.

Although CODES MENU options access tests specific to 4X4-controlled electronics, scan tool operation is the same as for ABS CODES MENU options. Refer to “Data Display” on page 108 for detailed instructions.

The DATA DISPLAY selection is available on most 1996 and later vehicles. It operates like Data Display for Ford engine testing. See “Data Display” on page 108 for detailed information.

6.6 Testing Airbag Systems

NOTE:
Information in this section does not cover pre-1996 EEC-IV SRS systems. These earlier systems flash the DTC on the SRS warning lamp as soon as the code sets. The control module does not store codes or provide data.

Select AIRBAG-RCM from the System Selection menu to open the MAIN MENU (RCM/ECS) (Figure 6-68). Airbags, or the Supplemental Restraint System (SRS), with a data stream are found on some 1995 and most 1996 and later OBD-II Ford models.

When the control module sets a code, it continuously flashes the SRS warning lamp on the instrument panel. The control module stores DTCs. The stored DTCs and data stream information are available through the OBD-II diagnostic link connector (DLC).

```
MAIN MENU (RCM/ECS)    CUSTOM SETUP
>DATA DISPLAY
 CODES MENU
 MOVIES
```

Figure 6-68 *Sample Ford Airbag testing main menu*

The SERVICE CODES selection from the MAIN MENU (RCM/ECS) offers the choices shown in Figure 6-69.

```
CODES MENU             CLEAR CODES
>MEMORY CODES
 KOEO SELF-TEST
 LAMP FAULT CODES
```

Figure 6-69 *Sample Airbag Service Code menu*

The DATA DISPLAY selection is available on most 1996 and later vehicles. It operates like Data Display for Ford engine testing. See “Data Display” on page 108 for detailed information.

6.7 Testing Anti-theft (PATS) Systems

After selecting PATS from the System Selection menu, the MAIN MENU (PATS) displays (Figure 6-70).

```
MAIN MENU (PATS)      CUSTOM SETUP
>DATA DISPLAY
 CODES MENU
 MOVIES
```

Figure 6-70 *Sample PATS main menu*

PATS systems have the following functions available:

- KOEO Self-Test
- Gather and clear memory codes
- Review and print codes (only after codes have been gathered)
- View data parameters

During the KOEO self-test, the PATS module transmits on-demand codes. Continuous codes are generated by selecting MEMORY CODES from the CODES MENU.

Although CODES MENU options access tests specific to PATS-controlled Electronics, scan tool operation is the same as for ABS Service Code Tests. Refer to “Codes Menu” on page 103 for detailed instructions. The DATA DISPLAY selection operates similarly to Data Display for Ford engine testing. See “Data Display” on page 108 for detailed information.

6.7.1 About PATS

PATS is a vehicle security feature introduced on 1996 and later vehicles. There are several variations, but all PATS modules generally work the same (Figure 6-71).

PATS consists of the following:

- **PATS control module**—communicates with the PATS transceiver to verify key code through the Tx and Rx signal wires.
- **SecuriLock Ignition Key(s)**—contains a unique key code that is “married” to the vehicle.
- **PATS Transceiver**—mounted on the ignition lock cylinder housing and energizes the ignition key electronics through circular antenna.
- **Powertrain Control Module (PCM)**—enables fuel pump and injectors if a valid PATS key is detected.
- **Theft lamp**—operates as follows:
  - Ignition = OFF: lamp flashes every two seconds to act as a visual theft deterrent on some vehicles.
  - Ignition = RUN or START: lamp flashes on for two or three seconds and then off.
  - System fault: lamp flashes briefly, and then flashes rapidly or remains on for one minute.

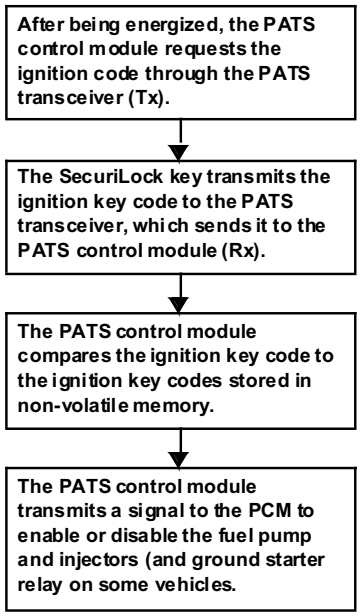
After being energized, the PATS control module requests the ignition code through the PATS transceiver (Tx).
The SecuriLock key transmits the ignition key code to the PATS transceiver, which sends it to the PATS control module (Rx).
The PATS control module compares the ignition key code to the ignition key codes stored in non-volatile memory.
The PATS control module transmits a signal to the PCM to enable or disable the fuel pump and injectors (and ground starter relay on some vehicles.

Figure 6-71 *Typical PATS operation*

6.7.2 PATS Applications

Table 6-1 provides PATS applications for specific vehicles. The five variations of PATS systems currently in use are described in Table 6-2, “PATS systems A–E” on page 114.

Table 6-1 *PATS system identification and location chart (sheet 1 of 2)*

MODEL	YEAR	PATS SYSTEM	MAX. KEYS	MIN. KEYS	STARTER INTERRUPT
Aviator	2003–04	C	8	2	YES
Blackwood	2002–03	C	8	2	NO
Continental	1998–2001	C	8	2	NO
Contour (V6 only)	1998	A	16	1	YES
	2/2/98–2000	E	8	2	YES
Cougar	1999–2002	E	8	2	YES
Crown Victoria	1998–2002	B	8	2	NO
	2003–04	E	8	2 or 3	YES
Econoline	PATS not available				
Escape	2001–04	E	8	2	YES
Escort	PATS not available				
Excursion	2000–04	B	8	2	NO
Expedition	1997–98	A	16	1	NO
	1999–2002	C	8	2	NO
	2003–04	E	8	2	YES
Explorer 4-door	1998–01	B	8	2	NO
	2002–04	E	8	2	YES
Explorer Sport	1998–2001 (before 7/24/00)	B	8	2	NO
	7/24/00–2003	E	8	2	YES
Explorer Sport Trac	2001 (before 7/24/00)	B	8	2	NO
	7/24/00–2004	E	8	2	YES
F150	2004	E	8	2	YES
F150 Classic	1999–2004	C	8	2	NO
F250 (under 8500# GVW)	1999–2000	C	8	2	NO
F250 (over 8500# GVW)	PATS not available				
F350	PATS not available				
Focus	2000–04	E	8	2	YES
Grand Marquis	1998–02	B	8	2	NO
	2003–04	E	8	2 or 3	YES
LS	2000–02	C	8	2	YES
	2003–04	E	8	2	YES
Mark VIII	1997–98	D	16	2	YES
Mountaineer (Early)					

Table 6-1 *PATS system identification and location chart (sheet 2 of 2)*

MODEL	YEAR	PATS SYSTEM	MAX. KEYS	MIN. KEYS	STARTER INTERRUPT
Mustang	1996–97	A	16	1	NO
	1998	B	8	2	NO
	1999–2004	C	9	3	NO
Mystique (V6 only)	1998	A	16	1	YES
	2/2/98–2000	E	8	2	YES
Navigator	1998	A	16	1	NO
	1999–2002	C	8	2	NO
	2003–04	E	8	2	YES
Ranger (3.0L & 4.0L only)	1999–2000	B	8	2	YES
Ranger (2.3L, 3.0L, & 4.0L)	2001–04	E	8	2	YES
Sable (Duratec only)	1996–97	A	16	1	NO
	1998–99	B	8	2	YES
Sable (all engines)	2000–04	E	8	2	YES
Taurus (Duratec only)	1996–97	A	16	1	NO
	1998–99	B	8	2	YES
Taurus (all engines)	2000–04	E	8	2	YES
Thunderbird	2002–04	C	8	2	YES
Town Car	1998–2002	C	8	2	NO
	2003–04	E	8	2 or 3	YES
Tracer	PATS not available				
Villager	PATS not available				
Windstar	1999–2000	C	8	2	YES
	2001–04	E	8	2	YES

Table 6-2 *PATS systems A–E (sheet 1 of 2)*

PATS SYSTEM	MODULE LOCATION	THEFT INDICATOR LAMP	
		IGN = RUN/START	IGN = OFF/ACCY
A	In a stand-alone module	On for 2 seconds, then off during normal operation	Flashes every 2 seconds for Contour/Mystique; does not flash for other vehicles*
B	In a stand-alone module	On for 3 seconds, then off during normal operation	Flashes every 2 seconds; does not flash for Mustangs*
C	In the instrument cluster (within the VIC, HEC, or ICM)	On for 3 seconds, then off during normal operation	Flashes every 2 seconds
*Operates differently if the vehicle is equipped with a perimeter theft system.			

Table 6-2 *PATS systems A–E (sheet 2 of 2)*

PATS SYSTEM	MODULE LOCATION	THEFT INDICATOR LAMP	
		IGN = RUN/START	IGN = OFF/ACCY
D	In the SCIL module	On for 2 seconds, then off during normal operation	Flashes every 2 seconds
E	In the PCM	On for 3 seconds, then off during normal operation	Flashes every 2 seconds
*Operates differently if the vehicle is equipped with a perimeter theft system.			

6.7.3 Important Tips for Testing PATS Systems

- When replacing keys, make sure the vehicle owner throws out all old keys.
- Erasing and reprogramming keys does not fix any known intermittent PATS no-start issues. Do not reprogram keys if a fault cannot be identified.
- Make sure you have all keys programmed into the PATS module when reprogramming or diagnosing.
- Always verify that there are no aftermarket devices causing interference, such as alarms, remote starters, or other devices using transponders. Devices that power up the PCM without powering up the PATS module may cause no-start problems.
- Some aftermarket audio equipment can keep the RUN/START circuit active for over 5 seconds past ignition off. This can prevent PATS from properly reading ignition keys during programming. Remove or disable aftermarket equipment if this occurs.
- Some objects can cause interference with the PATS key, like foil stickers, brass key tags, other PATS keys, transponders used to purchase gasoline, and other metallic objects.
- Reprogramming the PCM does not have any effect on PATS operation.
- Disconnect battery cables when replacing the PATS module.
- If the engine does not crank on vehicles that have PATS providing a ground to the starter relay, verify the PATS output to the starter relay.
- If the PCM sets code P1260 (see Table 6-3), look for other codes in the PATS module.
- Systems B, C, and E have an anti-scan function. If you attempt to start the vehicle with an unprogrammed key, the theft indicator lamp will flash rapidly and the vehicle will not start. Leave the key in the RUN position for 30 seconds to allow the anti-scan feature to time out. The vehicle will fail to start during this 30-second time period even if a correctly programmed key is used.

6.7.4 PATS Diagnostic Trouble Codes

Table 6-3 provides explanations for PATS diagnostic trouble codes (DTCs).

Table 6-3 *PATS diagnostic trouble codes (DTCs) (sheet 1 of 2)*

DTC	EXPLANATION
B1213	Less than 2 keys are programmed into the PATS module. If this is the only code, then cycle another key in the ignition. If not, service other codes first.
B1232 B2103	Replace the transceiver (the antenna is damaged).

Table 6-3 *PATS diagnostic trouble codes (DTCs) (sheet 2 of 2)*

DTC	EXPLANATION
B1342	The PCM has a memory failure or is otherwise defective (System E only).
B1600	No PATS key is read by the PATS control module. Possible cause: there is damage to the key, the PATS transceiver, the PATS control module, or the circuits between the transceiver and the control module.
B1601	The key has not been programmed into PATS. Leave the ignition on for 30 seconds before programming the key to let anti-scan time out, then program the key.
B1602	PATS can only partially read the key. Possible causes: key is not approved for PATS; there is a problem with the transceiver; there is a problem with the remote starter; there is metal, another PATS keys, or a gasoline purchase transponder on the key chain.
B1681	The transceiver module signal was not received by PATS. Possible causes: the transceiver is not connect or is defective; there is a wiring problem between the transceiver and the PATS control module.
B2139	The PCM ID does not match between the PCM and PATS (PATS/ICM/VIC/HEC/SCIL). Reinitialization is required. Possible cause: PCM was replaced (Systems B and C only).
B2141	There is a non-volatile memory configuration failure—no PCM ID is stored in PATS. Reinitialization is required. Possible cause: PCM was replaced (Systems B and C only).
B2431	There is a key program failure due to a defective key or transceiver (System E only).
P1260	The PCM has disabled the vehicle and it will not start. Retrieve codes from PATS.
U1147	There is an SCP network problem between the PCM and PATS due to an incorrect PCM calibration (Systems B and C only). The PATS key, transceiver, or transceiver circuit cannot cause this code. This code should be accompanied by P1260 in the PCM. If code P1260 has not been set in the PCM, there could be a communication failure due to the PATS module powering up before the PCM.
U1262	There is an SCP problem between the PCM and PATS due to no messages being received from the PCM. Possible causes: PCM is not powered up; there is a wiring issue with the SCP circuits (Bus +, Bus -). This is only a PATS fault if the theft indicator lamp is flashing.

6.8 Super Star II Emulation Mode

In this mode, scan tool operations are similar to the Ford Super Star II Tester factory scan tool. Use the Super Star II Test Emulation Mode to read codes on the following systems:

- Integrated vehicle speed control (IVSC)
- Automatic Ride Control (ARC)
- Air Suspension and Automatic Ride Control (ASARC)
- 4-speed electronic automatic transmission (4EAT)

The Super Star II Emulation Mode may also be used to test an EEC-IV, MCU, or MECS engine control systems as well as ABS control systems. This test mode may be convenient for technicians familiar with the Ford tester. Refer to Ford service procedures for the specific vehicle year, model, and system, and for procedures to test these systems.

To enter Super Star II Emulation mode:

- Select **TESTER MODE SELECTION MENU > SUPER STAR II EMULATION MODE**. The Super Star II operating screen displays (Figure 6-72).

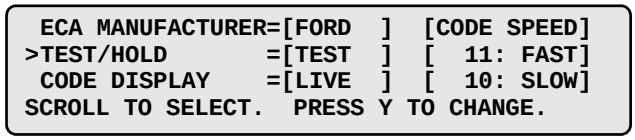

Figure 6-72 *Super Star II operating screen*

6.8.1 Super Star II Controls and Indicators

Scan tool controls operate as follows in the Super Star II mode:

- Moving the cursor up and down selects any of the three functions on the screen.
- The **Y** button switches between alternate functions as indicated by the cursor.
- The **N** button exits from the Super Star II mode back to the starting test selection screen.

6.8.2 Basic Super Star II Operation

The following sections outline basic Super Star II operations for testing Ford electronic systems. Refer to Ford test procedures in Ford service manuals or equivalent publications for specific instructions.

ECA Manufacturer

The manufacturer of the electronic control assembly (ECA) for the test system must be identified when using Super Star II Emulation Mode. There are two choices: Ford and Mazda.

Mazda control systems are used for:

- 1994–97 Aspire with 1.3L engine
- 1991-94 Capri with 1.6L engine
- 1992–96 Escort and Tracer with 1.8L engine
- 1988–93 Festiva with 1.3L engine
- 1989–95 Probe with 2.0L, 2.2L, and 2.5L engines
- 1988–91 Tracer with 1.6L engine

All other models use a Ford system. The ECA MANUFACTURER selection affects test procedures and code displays on the test vehicle.

NOTE:
Some 4EAT transmissions use a separate MECS transmission control module (TCM).

Test/Hold

When the cursor is in the Test/Hold position, the **Y** button works as the Test/Hold button on the Super Star II tester. The Test/Hold button is the main control on the Super Star II tester.

To begin a test:

- Select **TEST/HOLD** to display TEST.

NOTE:
Be aware that if **Y**, or hold, is pressed during most self-test code output transmissions, codes are erased from memory. Follow Ford test procedures exactly.

Code Display

There are two code display modes, live and review. In the live mode, codes display “live” as the vehicle transmits them, at the right of lines two and three under the heading CODE. The first code received displays on line two; the second on line three. As more codes are received, they move upward on the display lines. The most recent code displays on line three.

To review codes:

1. Select **CODE DISPLAY** to display REVIEW.
2. Review all codes recorded in memory.

   While reviewing codes, the scan tool continues to receive any codes that are transmitted and may add new ones to the list. The most recent code is at the bottom of the list, followed by an “end” message. Press **Y** at any time to return to viewing live codes. The selection preset is live.

   If the scan tool memory becomes filled with codes, the message at the end of the list changes to read “full.” If this occurs, press **N** to exit from the Super Star II mode and clear the memory. Then press **Y** to reenter for further testing.

Code Speed

The scan tool receives and displays both fast and slow codes and indicates whether each code was a fast or a slow transmission under the code speed display.

Some systems transmit both fast codes and slow codes; others transmit only slow codes. Code speed does not affect code meaning. Fast codes are transmitted one time each. Slow codes are transmitted two times each. The scan tool records and displays all codes.

Reading Codes

Most Ford ABS, cruise control, and other electronic systems transmit codes after the self-test starts. Some systems transmit a “pass” code if no faults are present. Others transmit nothing if no faults are present.

Some systems may take up to one minute to transmit the first code, or may pause for 30 seconds or a minute between codes. Certain systems transmit only one code at a time, which must be corrected before other codes are transmitted.

Because of code variations, it is important to exactly follow the Ford test procedures for the specific vehicle and system being tested.

Clearing Codes

Several different methods are used to clear codes from various Ford electronic systems. Some require that the vehicle battery be disconnected to clear codes from the control module. Refer to Ford test procedures for the exact vehicle and system being tested for instructions to clear codes.

The code memory of the scan tool clears automatically every time you exit from the Super Star II emulation mode.

6.9 Testing 4EAT Systems

The 4-speed Electronic Automatic Transmission (4EAT) is available on some 1989 and later Probe and 1990 and later Escort and Tracer models. On the 1990–92 4-cylinder non-turbo Probe and the 1993 1.9L Escort, the 4EAT is integrated with the MECS. All other 1990 and later Probe, Tracer, and Escort models use a separate test procedure for the 4EAT.

NOTE:
The scan tool must be operating in the Super Star II mode, as discussed earlier, to test the 4EAT control system. See “4-Speed Electronic Automatic Transmission (4EAT)” on page 66 for test connection instructions when testing models that transmit 4EAT data on the engine diagnostic connector.

The 4EAT system records service codes in memory and transmits codes in more than one test mode. Because several different tests are possible, refer to Ford procedures for the specific vehicle.

Available tests include:

- Wiggle test (engine off)
- Wiggle test (engine running)
- Key-on, engine-off (KOEO) self-test

Five 4EAT codes are available:

- 55—Pulse Generator
- 60—1-2 Shift Solenoid (SS1)
- 61—2-3 Shift Solenoid (SS2)
- 62—3-4 Shift Solenoid (SS3)
- 63—Lockup Solenoid (SS4)

Follow Ford procedures and the instructions below for 4EAT testing.

To start a 4EAT test in Super Star II Mode:

1. Switch the ignition off before starting a 4EAT test. Follow the Ford test steps exactly.
2. Select “ECA manufacturer=[Mazda].”
3. Turn the ignition on or off and press **Y** at the “test/hold” position as directed.
4. Read codes as they appear on the display.
5. Follow Ford test procedures to troubleshoot and clear codes and to perform specific functional tests.

6.9.1 Gathering Codes—1991–95 Escort and Tracer

Use an analog voltmeter to gather 4EAT codes on a 1991–92 Escort or Tracer with a 1.9L engine, or a 1991–95 Escort or Tracer with a 1.8L engine. The DTC output voltage from these models is low (about 0–2 V). Set the voltmeter to the 2 V scale and connect it as shown in Figure 6-73 and Figure 6-74.

The self-test input (STI) is internally grounded in the transmission control module, so codes output continuously until the ignition is switched off. The first digit of the DTC sweeps longer than the second digit. For example: a DTC 61 has 6 long sweeps followed by 1 short sweep of the voltmeter needle.

To read 4EAT codes on 1.9L 1991–92 Escort and Tracer:

- Connect an analog voltmeter to the STO terminal of the 4EAT connector (Figure 6-73).

NOTE:
Connect the negative voltmeter lead to the negative battery terminal.

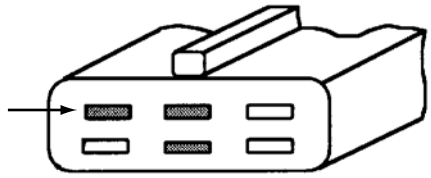

Figure 6-73 *STO terminal on the 6-pin 4EAT test connector*

To read 4EAT codes on a 1.8L 1991–95 Escort or Tracer:

- Connect an analog voltmeter to the pins shown in Figure 6-74.

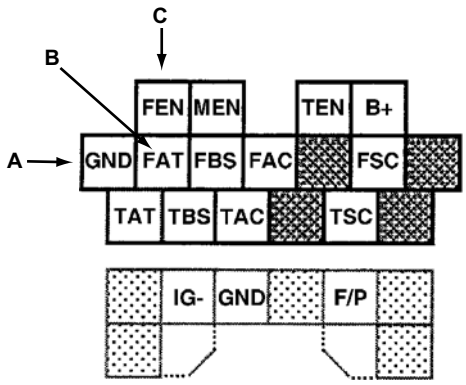

Figure 6-74 *Code-reading pin locations for 1991–95 Escort and Tracer*

A—Ground
B—Connect here for 1991–92 models
C—Connect here for 1993–95 models